

REMARKS

1. INTRODUCTION

In the present amendment, independent claim 1 and dependent claims 73-78 have been amended, dependent claim 72 has been cancelled, and new claims 79-105 have been added. Claims 71 and 73-105 are presently pending in this application. Applicants respectfully request reconsideration of the application in view of the foregoing amendments and the following arguments.

2. AMENDMENT TO CLAIMS

Independent claim 71 has been amended by incorporating therein the subject matter of cancelled claim 72 relating to the provision of one or more inlet apertures in the first heat exchanger section. The dependencies of claims 73 and 76 have been amended in consequence of the cancellation of claim 72. The dependency of claim 78 has been corrected to depend from claim 71 rather than claim 76. Claims 71 and 73-78 have been further amended in a number of minor respects in order to improve the clarity thereof and to avoid confusion between the components of the first and second heat exchanger sections. Applicants submit that none of these amendments adds any new matter.

3. NEW CLAIMS

New dependent claim 79 more specifically recites the structure of the second heat exchanger section. Support for this amendment can be found in the specification and drawings as originally filed, including at paragraph [0096] and in Figures 17 and 19.

New dependent claim 80 recites the position of the inlet for the gaseous fluid in the second primary shell member. Support for this amendment can be found in the specification and drawings as originally filed, including at paragraph [0096] and in Figures 17 and 19.

New dependent claim 81 recites that the first primary shell member is provided with an outer shell with a fuel inlet. Support for this amendment can be found in the specification and drawings as originally filed, including at paragraph [0097].

New dependent claim 82 recites that the first tube sheet device includes a first secondary shell member in which a first catalyst is mounted. Support for this amendment can be found in the specification and drawings as originally filed, including at paragraph [0095] and Figures 17 and 19.

New dependent claim 83 recites that the first catalyst is a fuel transformation catalyst. Support for this amendment can be found in the specification and drawings as originally filed, including at paragraph [0092].

New dependent claim 84 recites that the first catalyst is an autothermal reformation catalyst. Support for this amendment can be found in the specification and drawings as originally filed, including at paragraph [0095].

New dependent claim 85 recites a second catalyst located between the first tube sheet and the second tube sheet device. Support for this amendment can be found in the specification and drawings as originally filed, including at paragraph [0093] and Figures 17 and 19.

New dependent claim 86 recites that the second tube sheet device of the second heat exchanger section includes a secondary shell member in which the second catalyst is mounted. Support for this amendment can be found in the specification and drawings as originally filed, including at paragraph [0096] and in Figures 17 and 19.

New dependent claims 87 and 88 more specifically define the second catalyst. Support for these amendments can be found in the specification and drawings as originally filed, including at paragraph [0095] and in Figures 17 and 19.

New dependent claim 89 recites that the fuel conversion reactor includes an outlet for the gaseous mixture exiting the second plurality of heat exchange tubes. Support for this amendment can be found in the specification and drawings as originally filed, including at paragraph [0096] and in Figures 17 and 19.

New dependent claim 90 more specifically describes the configuration of the passageway recited by claim 73. Support for this amendment can be found in the specification and drawings as originally filed, including at paragraph [0098] and in Figure 17.

New dependent claim 91 more specifically describes the configuration of the outlet apertures of the second primary shell member and the inlet apertures of the first primary shell member. Support for this amendment can be found in the specification and drawings as originally filed, including at paragraphs [0101] and [0102], and in Figures 17 and 18.

New dependent claim 92 recites that the outlet apertures in the first primary shell member comprised a disconnected joint. Support for this amendment can be found in the specification and drawings as originally filed, including at paragraphs [0099], [0100] and [0103] and in Figures 17 and 18.

New dependent claim 93 more specifically describes the flow path for the gaseous fluid in the context of claim 77, in which the inlet apertures comprise a continuous annular gap between the first and second primary shell members. Support for this amendment can be found in the specification and drawings as originally filed, including at paragraph [0105] and in Figure 19.

New independent claim 94 is similar in structure to amended claim 71, but more specifically relates to a heat exchanger of the type shown in Figure 16 including a mixing chamber define between the primary end of the first primary shell member and the secondary end of the second primary shell member. Support for this amendment can be found in the specification and drawings as originally filed, including at paragraph [0092] and in Figure 16.

New claims 94-105 depend from independent claim 94. Most of these claims are derived from other claims now on file in this application. More specifically, claims 94-103 are derived from claims 76, 79, 80, 82-86 and 88, respectively.

New dependent claim 104 recites that the fuel conversion reactor further comprises a third catalyst. This amendment is supported in the specification and drawings as originally filed, including at paragraph [0092] and in Figure 16.

New dependent claim 105 recites that the third catalyst comprises a low temperature gas shift catalyst. This amendment is supported in the specification and drawings as originally filed, including at paragraph [0092] and in Figure 16.

Applicants submit that the new claims do not add any new matter.

4. CLAIM REJECTIONS – 35 U.S.C. § 112

The Examiner rejected claim 71 as being indefinite for use of the term “said gaseous mixture” in lines 16-17, on the basis that there is insufficient antecedent basis for this limitation in the claim. Applicants would like to point out the recital of “a gaseous mixture” in the preamble in claim 71, which provides an antecedent for the term “said gaseous mixture” at lines 16-17. This rejection should therefore be withdrawn.

The Examiner also rejected claims 77-78 on the basis that it is unclear how the limitations of “a continuous annular gap between the first and second shell members” (claim 77) and “wherein the one or more inlet apertures comprises a disconnected joint formed in the sidewall of the first shell member proximate its primary end” (claim 78) apply to the respective Figures.

The above-mentioned limitations of claims 77 and 78 can best be explained by reference to the drawings. With regard to the “continuous annular gap”, this element is identified in Figure 19 by reference numeral 654. As recited by claim 77, this annular gap is formed between the primary (lower) end of the first shell member 630 and the secondary (upper) end of the second shell member 530.

With regard to the one or more inlet apertures recited by claim 78, these apertures are formed in the primary (lower) end of the first heat exchanger section, and are identified in Figure 17, for example, by reference numeral 548. As mentioned above, the dependency of claim 78 has been corrected to depend from claim 71 rather than claim 76.

In view of the above explanation, it is submitted that claims 77 and 78 as amended are clear. This rejection should therefore be withdrawn.

5. CLAIM REJECTIONS – 35 U.S.C. § 103

Claims 71-78 stand rejected under 35 USC 103(a) as being unpatentable over Hotta et al. (US 2005/0129593 A1). Applicants respectfully submit that the rejection is improper because the Examiner has failed to establish a prima facie case of obviousness with respect to these claims.

“Patent examiners carry the responsibility of making sure that the standard of patentability enunciated by the Supreme Court and by the Congress is applied in each and every case.” MPEP § 2141 (emphasis in original).

To establish a prima facie case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all of the claim limitations.

MPEP § 2143. Applicants submit that the Examiner has failed to establish a prima facie case of obviousness with respect to claims 71-78.

The Examiner admits that Hotta et al. fails to teach a second heat exchanger having a second shell member that is concentric/coaxial with said first primary shell member with the primary end of the first shell member being located proximate the secondary end of the secondary shell member and having a similar structure to the first heat exchanger. However, the Examiner takes the position that the limitations pertaining to the second heat exchanger section are mere duplication of parts.

The Applicants respectfully disagree with the Examiner and submit that the rejection of claims 71-78 under 35 USC 103(a) is improper because the combination of first and second heat exchanger sections as recited by amended claim 71 does not provide a mere duplication of the Hotta et al. heat exchanger. Rather, the combination of the first and second heat exchanger sections as recited by claim 1 provides a new and unexpected result which would not be obtained by mere duplication of the Hotta et al. heat exchanger.

As mentioned above, independent claim 71 recites a fuel conversion reactor including a shell-end-tube heat exchanger comprised of two sections. The fuel conversion reactor of claim 71 includes a first heat exchanger section and a second heat exchanger section. Each of the heat exchanger sections includes a shell member. For example, with reference to Figure 17, the heat exchanger shown therein includes a first primary shell member (upper shell 130) and a second primary shell member (lower shell 530). The two shell members 130 and 530 define heat

exchanging chambers 100 and 506, respectively. Within these chambers 100 and 506, heat is exchanged between a gaseous mixture flowing through tubes 50 and a gaseous fluid flowing through the spaces surrounding tubes 50.

As recited by paragraph (b)(i) of claim 71, there is flow communication between the first and second heat exchanging chambers, with the gaseous fluid exiting the second heat exchanging chamber 506 through one or more outlet apertures 546 and entering the first heat exchanging chamber through one or more inlet apertures 548. In the context of the embodiment of Figure 17, this type of structure provides a benefit in that the gaseous fluid introduced into the second heat exchanging chamber 506 is preheated by the reformat flowing from the second catalyst 62, and avoids super cooling of the reformat passing between catalysts 72 and 62. This is more fully explained in paragraphs [0093] and [0094] of the specification as filed.

It is submitted that mere duplication of the Hotta et al. heat exchanger would neither provide the structure nor the benefits of the fuel conversion reactor as recited by amended claim 71, in which the two heat exchanging chambers are in flow communication with one another so that a gaseous fluid may be preheated in the first heat exchanger section prior to entering the second heat exchanging section. For at least these reasons, independent claim 71 and dependent claims 72-93 are patentable over Hotta et al.

New independent claim 94 recites a heat exchanger which may have the form of heat exchanger 400 shown in Figure 16. The structure of the heat exchanger recited by claim 94 is very similar to that recited by claim 71, and similarly distinguishes over Hotta et al. on the basis that the first and second heat exchanger sections of the fuel conversion reactor of claim 94 are not mere duplications of the Hotta et al. heat exchanger. With reference to Figure 16, the fuel conversion reactor of claim 94 provides a mixing chamber 406 defined between the primary (lower) end of the first primary shell member 30 and the secondary (upper) end of the second primary shell member 130. In the embodiment of claim 94, the first tube sheet 58 of the first shell member 30 seals the heat exchanging chamber of the first primary shell member 30 against flow communication with the mixing chamber 406 and the heat exchanging chamber of the second shell member 130. Again, the structure of claim 94 is not a mere duplication of parts, due to the specific arrangement of the heat exchanging chambers and the mixing chamber, which

creates a flow pattern having new and unexpected results which are not provided merely by duplicating the Hotta et al. structure. In particular, with reference to the embodiment of the invention shown in Figure 16, the structure shown therein is advantageous in that it permits the incorporation of a fuel transformation catalyst 72, a high temperature shift reaction catalyst 72 and a low temperature shift reaction catalyst 62 into a single reactor. There is no teaching or suggestion of such a structure in the Hotta et al. reference.

For at least the above reasons, independent claim 94 and dependent claims 95-105 are allowable over Hotta et al.

Accordingly, Applicants request that the rejection of claims 71-78 under 35 U.S.C. § 103(a) be withdrawn.

9. CONCLUSION

For the above cited reasons, all of the claims presently pending in this application are believed to be allowable. If the Examiner has any further questions or concerns, the Examiner is invited to contact the Applicants' undersigned attorney.

Respectfully submitted,

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